

CLAIMS

1. A thin-film piezoelectric resonator comprising:
 - a substrate having a cavity which penetrates through from the principal surface to the bottom surface thereof;
 - a lower electrode provided on the principal surface of the substrate so as to cover the cavity;
 - a piezoelectric film provided on the lower electrode so as to be located above the cavity; and
 - an upper electrode provided on the piezoelectric film, including:
 - a main portion which overlaps a part of the cavity in a plan view,
 - a protruding portion, which is connected to the main portion, a part of which overlaps the cavity and the remaining part thereof does not overlap the cavity but overlaps the lower electrode,
 - an extension portion provided at the opposite side of the main portion from the protruding portion, and
 - a connecting portion, which connects the main portion and the extension portion, provided so that at least a part thereof does not overlap the cavity but overlaps the lower electrode,
 - the length of the protruding portion in a direction perpendicular to a direction of connecting to the main portion being substantially the same as the length of the connecting portion in a direction perpendicular to a direction of connecting to the main portion.

2. The thin-film piezoelectric resonator as claimed in claim 1, wherein the remaining part of the protruding portion and the part of the connecting portion are placed symmetrically with respect to a center line of the cavity.
3. The thin-film piezoelectric resonator as claimed in claim 1, wherein the remaining part of the protruding portion and the part of the connecting portion are placed asymmetrically with

respect to a center line of the cavity.

4. The thin-film piezoelectric resonator as claimed in claim 1, wherein the length of the protruding portion in a direction perpendicular to a direction of connecting to the main portion is smaller than the length of the main portion in a direction perpendicular to a direction of connecting to the protruding portion.

5. A thin-film piezoelectric resonator comprising:
a substrate having a cavity which penetrates through from the principal surface to the bottom surface thereof;
a lower electrode provided on the principal surface of the substrate so as to cover the cavity;
a piezoelectric film provided on the lower electrode so as to be located above the cavity; and
an upper electrode provided on the piezoelectric film, including;
a main portion which overlaps a part of the cavity,
a first portion provided so as to connect to one of sides of the main portion,
a second portion provided so as to connect to the other one of the sides of the main portion, and
a link portion linking the first portion and the second portion, the link portion not overlapping the lower electrode in a plan view,
the length of the first portion in a direction perpendicular to a direction of connecting to the main portion being substantially the same as the length of the second portion in a direction perpendicular to a direction of connecting to the main portion.

6. The thin-film piezoelectric resonator as claimed in claim 5, wherein the first portion and the second portion of the upper electrode are placed symmetrically with respect to a center line

of the cavity.

7. The thin-film piezoelectric resonator as claimed in claim 5, wherein the first portion and the second portion of the upper electrode are placed asymmetrically with respect to a center line of the cavity.

8. The thin-film piezoelectric resonator as claimed in claim 5, wherein the length of the first portion of the upper electrode in a direction perpendicular to a direction of connecting to the main portion is smaller than the length of the main portion in the perpendicular direction.

9. A filter circuit comprising the thin-film piezoelectric resonator as claimed in claim 1.

10. The filter circuit as claimed in claim 9, wherein the remaining part of the protruding portion and the part of the connecting portion of the thin-film piezoelectric resonator are placed symmetrically with respect to a center line of the cavity.

11. The filter circuit as claimed in claim 9, wherein the remaining part of the protruding portion and the part of the connecting portion of the thin-film piezoelectric resonator are placed asymmetrically with respect to a center line of the cavity.

12. The filter circuit as claimed in claim 9, wherein the length of the protruding portion in a direction perpendicular to a direction of connecting to the main portion of the thin-film piezoelectric resonator is smaller than the length of the main portion in a direction perpendicular to a direction of connecting to the protruding portion.

13. A filter circuit comprising the thin-film piezoelectric resonator as claimed in claim 5.

14. The filter circuit as claimed in claim 13, wherein the first portion and the second portion of the upper electrode of the thin-film piezoelectric resonator are placed symmetrically with respect to a center line of the cavity.
15. The filter circuit as claimed in claim 13, wherein the first portion and the second portion of the upper electrode of the thin-film piezoelectric resonator are placed asymmetrically with respect to a center line of the cavity.
16. The filter circuit as claimed in claim 13, wherein the length of the first portion of the upper electrode in a direction perpendicular to a direction of connecting to the main portion of the thin-film piezoelectric resonator is smaller than the length of the main portion in the perpendicular direction.